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OBSERVATIONS

ON

Animal Electricity.

IN

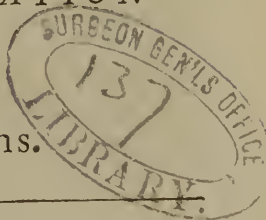
EXPLANATION

OF THE

METALLIC OPERATION

OF

Doctor Perkins.



BY

JOHN VAUGHAN, M. P. M. S.

FELLOW OF THE MEDICAL SOCIETY OF
DELAWARE.

“ Who shall decide, when Doctors disagree ? ”

DRYDEN.

WILMINGTON—FROM THE OFFICE OF THE
DELAWARE GAZETTE, BY
W. C. SMYTH.

1797.

(No. 1.)

District of }
Delaware. } ff.

BE IT REMEMBERED,
 That on the twenty-first day of July, in the
 twenty-second year of the Independence of the
 United States of America, JOHN VAUGHAN,
 of the said district, hath deposited in this Of-
 fice, the Title of a Book, the Right whereof
 he claims as Author, in the words following,
 viz. " OBSERVATIONS ON ANIMAL
 " ELECTRICITY, IN EXPLANATION
 " OF THE METALLIC OPERATION OF
 " DR. PERKINS, BY JOHN VAUGHAN,
 " &c." in conformity of an Act for the En-
 couragement of Learning, by securing Maps,
 Charts, and Books, to the Authors and Pro-
 prietors of such Copies, during the times
 therein mentioned.



I DO CERTIFY, That the
 above is a true Copy of the Re-
 cord thereof. IN TESTIMONY
 whereof I have hereunto set my
 hand and affixed the seal of the
 district aforesaid, this twenty-first
 day of July, in the twenty-second
 year of the Independence of the
 United States of America.

JOHN CONWAY, Clk.
 Delaware District.

400094

TO THE
AMERICAN PHILOSOPHICAL SOCIETY.

Gentlemen,

IN prelininating the following pages to the literati of America, I necessarily feel all that diffidence due to superior knowledge, and to the patrons of that grade of existence, in which I am but in embryo! I however beg the privilege of declaring, that my embarrassment is considerably lessened, by a consciousness that my appeal is made to the liberal and candid:—it is their indulgence alone, that I am ambitious to merit. The true philosopher ever holds the balance of equity, with an unbiassed hand, and discriminates impartially between truth and error. The objects to which I solicit your attention, are the sublime and intricate subjects of Animal Electricity, and Dr. Perkins' Metallic Operation. The former is yet too much involved in the mystic garb of nature; and the latter is likely to form a new era in the healing art. Both of these are pleasing objects of pursuit to the inquisitive philosopher, who is ever anxious to cultivate and mature e'en a hydra-germ of nature.

The heterogeneous contents of the following pages, (though crude and undigested) may perhaps excite

the attention of your expansive minds to the further consideration, and not improbably to the elucidation of this highly interesting subject. Should I be so fortunate, as to have suggested a single idea, or made a compilation of facts that may reflect the least gleam of light thereon—I doubt not but it will flourish under your auspices. And the most prominent feature in the character of a philosopher induces me to hope, that your censure will be mild—though your decision may be founded on a tenacity for truth.

I am,

Gentlemen,

With the most profound respect,

Your most obedient humble servant,

THE AUTHOR.

L E T T E R

FROM

JAMES TILTON, M. D.

PRESIDENT of the MEDICAL SOCIETY of
the STATE of DELAWARE, &c. &c.*To the AUTHOR.*

DEAR SIR,

I am very glad that you have at length overcome the restraints of diffidence, by giving us your thoughts on Electricity, in explanation of Dr. Perkins' metallic operation.

That some general principle exists, which gives the metals a powerful influence on the Animal Economy, is now acknowledged by Philosophers, the most candid and best qualified to judge of this matter. Even Mesmer, in his application of the metals, was patronized by the ablest Physicians of Germany; until he covered and obscured those simple facts, which should have been improved for the benefit of Society, with a pile of empirical frauds, that had no object beyond the accumulation of money. Instead of involving Perkins in the disgrace of Mesmer, I apprehend we ought

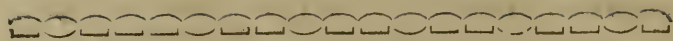
rather to contrast the honest man with the rogue : for without art or affectation, Dr. Perkins barely discloses useful facts, by means the most simple & easy. It must be confessed, however, that many reject our general principle. Like infidels to the Gospel, they admit of no mysteries, and refuse to believe what they do not comprehend. Others who acknowledge that a general principle pervades the Animal Economy, on which the metals have influence, nevertheless, dispute about what this notable power may be. Both these classes of men ought to thank you. To the one you may give a reason they did not apprehend; and the other should wish for the best account known or well understood. For my own part, I frankly confess I shall be satisfied with the principle of ELECTRICITY, until the phenomena are better explained by means of some other.

By publishing to the World the thoughts which you have digested and arranged on Animal electricity, and the manner in which it explains the metallic operation, you will at least invite discussion, and may profit with the rest of your brethren, by the event.

With great respect, I am,
Dear Sir,
Your friend and humble servant,

JAMES TILTON.

Wilmington,
July 20, 1797.]



To JAMES TILTON, M. D.
 PRESIDENT of the MEDICAL SOCIETY
 OF
 DELAWARE, &c. &c.

DEAR SIR,

I hope you will permit me to express the gratification I feel, in receiving your approbation to the contents of the following pages. The uniform liberality and candor, with which you have ever treated the subject on which they are founded, demands not only an unfeigned acknowledgment, in gratitude, from me; but merits a tribute of respect from every friend to science.

That you may long continue our professional patron, is the sincere wish of

Your much obliged friend,

and most obedient, humble servant,

THE AUTHOR.

Christiana,
July 21, 1797. }



OBSERVATIONS

O N

Animal Electricity.

NOTHING has been so great an obstacle to the advancement of Medical Science, as the partiality and obsequious regard which the generality of Physicians of all ages have paid to great authorities. For whilst they disregard the testimony of their senses, and indolently assent to things on the credit of others, they remain passive dupes to their own credulity, and seldom examine whether they are right or wrong. An error thus admitted, is reluctantly corrected, and becomes the copious source from which numberless false opinions flow.

There are perhaps but few that are not diffident in deviating from principles established by men of general erudition, whose geniuses were qualified to interrogate nature with success:—But an error once discovered should be immediately corrected, in opposition to the *ipse dixit* of all the dogmatists of seventeen centuries.—Man by nature possesses a *nifus formativus*, and

is as prone to novelty and investigation, as the earth is to revolve from ungovernable laws of nature. Yet, there are few discoveries in the healing art but what meet with tumultuous opposition, from the congregated legions of prejudice, ignorance and ambition. Some nominal philosophers disbelieve every proposition that does not accord with the infallible doctrines of their immaculate ancestors; and others are so extremely illiberal, as to discard every new principle in which they can have no claim to interest. A glaring example of the latter we have, in the degrading denunciations of the English philosophers, when the illustrious Dr. Franklin's discovery of the identity of Lightning and Electricity was first delivered to the world. A second, no less true, we have in the discovery of Dr. Perkins' Metallic Operation, which will like the former arise triumphant amidst the counter, but futile, vociferation of prejudice and ignorance. Some reject the latter, because they were not the inventors. Others question the testimony of their senses, because they cannot explain the *modus operandi* thereof, by referring it to the good old doctrines of Van Helmont, Doleus, or Stahl. Yet the happy day is perhaps not far distant, when envy must fall a sacrifice to truth, and behold this problem accounted for, on a native law of the animal œconomy.

That the bodies of animals possess a fluid analogous to electricity, had long been suspected by Physiologists and other speculative philosophers. The matter long rested however on

pure conjecture alone, and the apparent intricacy of the subject depressed the hopes of the boldest experimenters. But accident not unfrequently does more for the real advancement of science, than boasted art and genius are able to accomplish. It was accident that first suggested to the celebrated *Gallileo*, the construction of that optical instrument denominated the telescope. It was accident that first led the immortal *Newton* to the original conception of that principle of gravitation, by which he afterwards explained with such facility the movements and exquisite balance of the material universe. It was also accident—that first suggested to the ingenious and industrious *Galvani*, the mode of experimenting with effect on the sublime and intricate subject of Animal Electricity. “ Whilst Professor *Galvani* was engaged in dissecting a frog, in a room where some of his friends were amusing themselves with an electrical-machine, one of them drew a spark from the conductor, at the same instant that the professor touched one of the nerves of the animal. In an instant the whole body of the frog was shook by a violent convulsion. The professor was astonished at the phenomenon, and believed it owing to his having wounded the nerve. To assure himself whether this was really the case or not, he pricked it with the point of his knife; he then touched the nerve with the instrument as at first, and ordered a spark to be taken from the machine; on which the contractions were renewed. The experiment was repeated a third

time, but the animal remained motionless.—However, upon perceiving that he held his scalpel by the handle, which was of ivory (a bad conductor) he changed it for a metallic one, and re-excited the movements, which he constantly failed of doing whilst using an electric substance. After having made a number of experiments with the electrical machine, he resolved to prosecute the subject with atmospheric electricity. With this view he raised a conductor upon the roof of his house, from which he brought an iron wire into his room, to this attached metal conductors, connected with the nerves of the animals destined to be the subjects of his experiments, and to their legs he tied wires which reached the floor.—Considerable movements were observed in the animals whether of cold or warm blood whenever it lightened. These preceded thunder, and corresponded with its intensity, and even took place when any stormy cloud passed over the apparatus. With similar views he suspended frogs on metal hooks fixed in the spine of the back, upon the iron railing of his garden; several times he remarked that these animals contracted, and appeared to receive shocks.—At first he conceived the movements were owing to changes in the atmosphere, but a more scrupulous examination undeceived him.—Having placed a prepared frog upon an iron plate in his room, and happening with his dissecting forceps to press it against the plate, he observed the movements to take place. This experiment succeeded with all metallic bodies,

but more particularly well with silver; non-conducting substances were not proper for it. From this period our author began to suspect the animal possessed an electricity of its own; and in this suspicion he confirmed himself, by a series of experiments coincident in the result. And no sooner had Professor *Galvani* published to the world his experiments on animal electricity, than their fame disspread swift as the intangible fluid they regarded. Dr. *Valli*, an *Italian* physician, was the first that co-operated with the celebrated *Galvani*, in investigating that animal fluid the existence of which had been so long suspected, but so lately realized by actual experiment. After repeating the experiments of his predecessor, and instituting a series of experiments sufficiently tedious and lengthy, Dr. *Valli* conceives himself unequivocally authorized to conclude, that the animal fluid of *Galvani*, was entirely the same with the subtle matter of electricity. This conclusion he alledges to be the spontaneous and necessary result of the following positions, which he delivers as substantiated and confirmed by actual experiment :

- “ 1st, Substances which conduct electricity, are conductors likewise of the nervous fluid.”
- “ 2dly, Substances which are not conductors of electricity, do not conduct the nervous fluid.”
- “ 3dly, Non-conducting bodies, which acquire by heat the property of conducting electricity,

preserve it likewise for the nervous fluid."

"4thly, Cold, at a certain degree, renders water a non-conductor of electricity, as well as of the nervous fluid."

"5thly, The velocity of the nervous fluid is as far as we can calculate, the same with that of electricity."

"6thly, The obstacles which the nerves under certain circumstances oppose to electricity, they present likewise to the nervous fluid."

"7thly, Attraction is a property of the electric fluid, and this property has been discovered in the nervous fluid."

Having enumerated and detailed the foregoing arguments, the Doctor, in an effusion of triumph subjoins, "We here see the greatest analogy between these fluids; nay, I may even add, the characters of their identity." As an additional support to the same opinion, Dr. *Valli* adduces the peculiar and striking phenomena exhibited by the *Torpedo*, the *Gymnotus-electricus*, the *Silurus*, &c. which he supposes to proceed from a fluid in every respect the same with that discovered in frogs by the professor of anatomy at *Bologna*. In succession to Dr. *Valli*, Mr. *Fowler* entered the list of philosophers, in investigating the sublime but intricate subject of Animal Electricity. And to use his own words, "After," says he, "a great variety of experiments of which it would be unnecessary here to relate more than the result, I found, that I could not excite in an

animal the appearances described by *Galvani*, with any substances whatever, whether solid or fluid, except the metals : and that the mutual contact of two metals with each other, so far as I was able to determine, was in every case necessary to the effect." And after finishing a series of experiments, a series sufficiently numerous and diversified for the establishment of general principles, Mr. *Fowler* favours us with the following conclusions respecting the nature of the nervous fluid. When having stated a few analogies between the animal fluid of *Galvani*, and that of the *Torpedo*, &c. he then reverses the comparison and lays down several points of what he terms essential difference, not only between the two preceding fluids, but also between the fluid of *Galvani*, and the matter of electricity. " This influence," says he, (referring to the nervous fluid of animals) differs both from that of the *Torpedo*, &c. and from electricity, in producing no sensation (in man at least) at all similar to that of an electrical shock. They however produce a disagreeable sensation, even in frogs, independent of that which must necessarily arise from irritation and muscular contraction." But the most important and characteristic difference which I have yet discovered between this new influence and electricity, consists in their effects upon the contractile powers of animals. Electricity has a tendency to destroy that power upon which contraction depends; whereas the metals have in all my experiments had the directly opposite effect. " Oxygene is, so far as I know, the

only stimulus in nature, whose effects are at all analogous.* The difference here mentioned by Mr. *Fowler*, is in my opinion merely owing to the various degrees of the powers applied, and not to any specific or elementary difference in the powers themselves. The electrical shock is injurious and deleterious from excess, but in cases of diminished mobility from paralysis, contusion, &c. it is not only a salutary but an invaluable stimulus, and happily fitted to restore the contractile powers of the system.—From whence then arises this essential difference described by Mr. *Fowler*? It may be answered, that electricity is a salutary stimulus when applied in a proper degree, and injurious from excess alone.† Which is far from proving it to be naturally a noxious principle: for the whole class of natural and healthy stimuli, as, oxygenous gas, heat, animal food, exercise, spiritous liquors, &c. are not only injurious from excess, but will also impair the contractile powers of the system. To illustrate this subject a little farther, I will present the reader

* *The effects of oxygen on the system is so clearly illustrated in Dr. Beddoes' Essays on Pthipsis Pulmonalis, &c. that it is unnecessary to take notice of it at present, further than to mention that he proves it to be the principle of irritability of the muscular fibre.*

† *The ingenious Dr. Abildgaard has deprived foxes of all sensation and motion, by passing violent shocks through their heads; and re-animated them, by gentle shocks passed through the heart and lungs.*

with two of Mr. *Fowler's* experiments, in his own words:

EXPERIMENT 1.

“ I divided. (says he) the sciatic nerve of one leg, and tied the crural artery of the other in a large frog. Scarcely any blood was lost in doing either. Two days after this, I strangled it. During the first twenty-four hours, the leg in which the nerve had been divided, appeared to contract with the most vigour; after this period, the difference between them became more doubtful; but the contractions were at no time stronger in the leg whose artery was tied, than in that whose nerve was divided.

EXPERIMENT 2.

“ The same operations were performed on a large female frog full of spawn. Four hours afterwards she was covered by a male, who had been treated in a similar manner. I mention this circumstance, as it tends to prove, that the pain occasioned by the operation, was probably not so great as to produce much fallacy.

“ On the day following, she had spawned, and on the sixth day from the operation she was strangled. When laid upon a plate of zinc, and excited by means of a rod of silver, the contractions were found extremely feeble in the leg whose artery had been tied, and ceased altogether in about twenty-four hours after her death.

“ In the leg whose nerve had been divided, they appeared as vigorous as they usually are in legs to which no injury had been previously done, and continued excitable upwards of two days after they had ceased to be so in the other.”

To account for the difference in the results of those experiments, it is only necessary to consider the principles upon which the contraction of muscles depends; *i. e.* irritability and nervous energy. The first is more particularly the *vis muscularis*, and supplied by the blood; the latter is the exciting cause of muscular motion, and supplied by the nerves. Both principles suffer exhaustion, and require continual renovation. In Experiment 1st, a difference was perceptible only in the first twenty-four hours; but in Experiment 2d, the leg whose nerve had been divided, continued excitable two days longer than that whose artery had been tied. In the first case the leg whose artery had been tied, was but partially deprived of its irritability, and consequently remained susceptible of its natural agent, though supplied by art. But in the second case, during the abstinence of six days, its irritability was nearly exhausted, and its contractions could of necessity be but very feeble, and of short duration. Motion in animate matter depends on two principles abstractedly distinct, yet practically connected. First, a certain fitness, or capacity of being moved in the body to be put in motion; and, 2dly, the power of giving motion

in the agent or moving body. The blood furnishes muscles with irritability and nutrition, which completes their capacity, or predisposition to be put in motion, upon the action of the *vis nervæ*, whether the latter is applied thro' the medium of the nerves themselves, or by the application of metals. But to enter a little further into the principles of muscular motion, we find three powers essentially combined in constituting the mobility of muscles. First, Elasticity; secondly, Irritability; and thirdly, Nervous Energy. The first may be imputed to attraction, or its effect, which is cohesion. Cohesion is that wonderful property impressed on matter, by which its elementary particles when they approach each other to a certain degree, termed by philosophers its sphere of attraction, rush into contact; and remain in that state unless separated by a force superior to that of their attraction. Thus both solids and fluids do to a certain degree resist the disunion of their parts, and are capable of restoring their fibrils to their natural state, when stretched or over-distended by a force superior to that of cohesion. This elasticity resides in all the solids, but in different degrees; and being independent of the state of the nerves, is termed the elasticity of the dead fibre. The term, dead fibre, is made use of to distinguish certain properties arising from mere cohesion or mechanism, from those that depend on the vital principle.

The *vis insita* or irritability, is that principle by which the muscular fibres when irritated oscillate, contract towards the middle, becoming

by this means shorter and thicker, and alternately withdraw themselves from the middle with a degree of velocity that eludes calculation.—Muscles when dead or extracted from the bodies of living animals, retain this power a much shorter time than that of the dead force.* The principle of nervous energy exists in such various degrees in different parts of the muscular system, that it would extend this paper to the size of a folio volume, to specify the particular degrees thereof, in the diversified motions of the Animal Œconomy. I shall therefore only take a cursory view of its offices in voluntary and involuntary motion. In the former, this energetic principle is the immediate and exciting cause of muscular motion. When an impression is made on the sentient extremities of the nerves, it is immediately communicated to the brain, which reacting, produces thought, and a consequent determination of the will; and when any part is determined by the will to be put in motion, the nerves in consequence of a voluntary impression on the sensorium, execute this function by surcharging the muscles of the part with electricity. They, as natural electrics, can only retain a certain degree of electricity; and when more is forced into them by volition, it is of necessity discharged at their extremities in the muscles. Thus the various

* *Dr. Valli informs us, that immersion in water uniformly destroys the excitability of muscles within four hours; whereas in an ordinary way, they retain it twenty-four hours.*

passions of the mind often afford us melancholy specimens of a physical necessity being connected with our moral faculty, in producing convulsions, palpitations of the heart, asphyxia, and not unfrequently death itself.

Involuntary motion is also dependant on the nervous energy, as the action of the heart, lungs, &c. and if a nerve is divided, the dependant part suffers emaciation; and the action of the arterial system is diminished, even by a compression of the brain. Muscles of involuntary motion, have fewer nerves than those subservient to volition, their original formation is different, and the coating and exciter, says Dr. *Valli*, does not produce the least motion in them. Hence their different movements may very rationally be imputed to their different degrees of electricity. Voluntary muscles require a large number of nerves, and a strong charge of electricity to act in obedience to the will; while the latter require but few nerves, and a small degree of this principle, to enable them to perform their more passive functions. The actions of the latter are however, more uniform, and consequently their electricity exists but in one degree; while that of the former is positive and negative, and undergoing changes commensurate with their actions. There are also mixed motions in the human system, the causes of which are much more mysterious. On one hand there are examples of muscles, which, for the most part are obedient to the will; yet in certain cases refuse to obey its commands.—There are also instances of muscular functions,

which though naturally in subordination to the will, being performed without a consciousness of the mind. We often move our limbs when asleep. And we have accounts of somnambulists, that not only walk, but dance and perform feats of agility in their sleep, which they were incapable of doing when awake. Perhaps those phenomena must be imputed to the re-action of the sensorium, which is excited by the imagination waking up and exhibiting before it, the image of an active and customary stimulus. There also are a few of the functions of our bodies, over which the will of itself has no controul, may notwithstanding be excited and brought into action when the imagination and passions of the mind, act in concert with the will: assisted by the plastic power of custom. An astonishing specimen thereof we have in Colonel *Townsend*, who possessed, like the snail and tadpole, a power of suspending the action of the heart and arteries at pleasure. But in what manner the will obtains this power, when assisted by passion and custom, I refer to the metaphysician to determine. For I conceive that when a problem is traced to its connection between the mind and body, it has arrived to the *ultimatum* or *ne plus ultra* of physiological investigation. There however is reserved for the physiologist, a task equally difficult, in accounting for the spontaneous motions of the animal system; as that of the heart from the operation of foreign stimuli, independent of its native stimulus the blood, aliment, air, &c. stimulate the stomach and primæ

viæ, urine the bladder, light the iris, &c. For the performance of spontaneous motion, the application of foreign stimuli are generally requisite; though transitory spontaneous motions arise also from an irregular transmission of the electroid fluid. Whenever the nerves feel a stimulus, the electrical fluid is excited, and its effects are manifested in the production of motion; and when the stimulus is withdrawn or ceases to act, another effect is produced, which is relaxation. The latter, though generally an indirect effect, (or perhaps more strictly a negative condition) may notwithstanding be directly produced by the action of certain powers denominated sedatives; among which the *nicotiana* is probably the most unequivocal. In a case of incarcerated hernia, in which all manual attempts towards reduction were ineffectual, my worthy preceptor, Dr. Currie, of *Philadelphia*, concluded, that the operation alone could prevent immediate death. He directed an ounce of the *nicotiana* to be given in decoction *per injectione*; but the nurse inattentively gave a quarter of a pound. And a short time after when we returned to perform the operation, we found our patient to all appearances expiring. The Doctor, whose heart was never a stranger to sympathy, was not a little distressed to find his patient apparently dying from the negligence of his nurse. The event was however fortuitous. On examining the hernia, the distention and stricture were completely removed, and the protruded intestine was easily reduced without the pain

of a hazardous operation. The patient was perfectly restored by the aid of proper cordials.

A second example of the sedative power of tobacco I experienced myself. Having, from the free use of diluting liquids and inattention, brought on a mechanical ischuria, I tried opium, fomentations, &c. but to no effect.—When in extreme pain, I had recourse to a segar for amusement, by which an unexpected nausea was excited, succeeded by a relaxation of the sphincter vesicæ, and an involuntary efflux of urine. Fear, which is also a sedative power, will not only produce spontaneous convulsions or palpitations of the heart, but even death, or eventual relaxation. This viscus is the most susceptible of spontaneous motion, and will continue to act for some time after it is taken out of the body.

I have frequently taken out the hearts of frogs, turtles, &c. and observed attentively their actions. They will contract and dilate, *sua sponte*, for some time, and then cease; when they may be again excited to contract, by lacerating them with a wooden or other pointed instrument. But when they become no longer excitable by these means, they may be re-excited to contract, by the irritation of a metallic instrument. I once observed a similar phenomenon in an amputated leg; one of the crural muscles contracted upon being irritated with the point of a scalpel. The experiment was then tried with a pointed wooden instrument, but to no effect. Yet on irritating it a second time with the scalpel, it contracted

once or twice. Hence the application of metals, is one of the best and most delicate tests for ascertaining the least possible degrees of muscular irritability. After having become wholly insensible to the impressions of all other stimuli, they may be re-excited, on the application of their native stimulus.

Mr. *Fermin*, Dr. *Priestly*, Sir *Charles Linæus*, and others, observe that metals are the best conductors of Animal Electricity, and that some metals are better conductors than others. Water and wood are conductors of both animal and natural electricities. Those facts if considered impartially, certainly afford us the most unequivocal tests of the analogy of Natural and Animal Electricity. But Mr. *Fowler* observes that the relation of Natural and Animal Electricity is the most equivocal in man. It however would be irrational and unphilosophical to suppose, that nature had furnished such a variety of animals, and even subjects of the insect tribe, (for example the glow-worm) with this truly dignified property, and withheld it from the noblest and most perfect animal in the creation. Yet it must be admitted that the *Gymnotus*, &c. possess this property in a stronger degree than man.* But this does not imply a

* *Human Electricity may, notwithstanding its extra modification, be rendered obvious to the senses, by a very simple experiment. If a piece of zinc is placed on the tongue so that one end projects out of the mouth, and one end of a silver probe be placed in the internal canthus of the eye—when the inse-*

converse to the foregoing doctrine of gradual relationship. For though nature is uniform in her general law of concatenation, throughout animation, yet we find her as various in her organic modifications, as she is in her nominal products. Therefore we cannot assign any cause (connected with her laws of creation) why the electricity of the human system should not be more particularly modified, than that of the *Gymnotus*, &c. Wood and water are conductors of the latter, but not of the former; at least it is not yet ascertained. And though we cannot with precision, say why nominal electricity should be susceptible of metals only, yet the fact is incontestible, and sanctioned by the experiments of those gentlemen aforementioned, whose veracity is unquestionable. It is also further substantiated, by the discovery of Dr. Perkins' Metallic Instruments for removing pains, and topical affections. The Dr. observed to me, that he had made trial of all the various metals, but none are as effectual as those of which his tractors are composed. This discovery is as important in the healing art, as it is novel in the science of Physiology, and all that remains to illustrate the efficacy thereof, is a rational and philosophical demonstration of the principle itself, and an explanation of the *modus operandi*, on the established laws of the Animal Œconomy. This however, is considered problematical by some, and by others it is

rior point of the probe is brought into contact with the zinc, an evident flash is produced.

positively discarded. Yet to cease from inquiry, because we are sometimes mistaken, is no greater proof of wisdom, than to desist from walking because we sometimes stumble. And if we only take an impartial view of the operations of nature herself, and attend diligently to the analytical investigations of the aforementioned experimentalists on this sublime subject, I think the sceptic himself must admit, that the principle of nervous energy is a modification of electricity. As sensation is dependant upon this energy, a pleasurable sensation, on what may be termed a natural or healthy degree thereof; then certainly pain or super-sensation, can only depend on an accumulation of the electroid fluid, or extra degree of energy in the part affected. On this principle the problem admits of easy solution; namely, that the metals being susceptible of this fluid, conduct the extra degree of energy to parts where it is diminished, or out of the system altogether, restoring the native law of electric equilibrium. The particular affections in which this operation is the most effectual, are chronic rheumatisms, as lumbago, sciatica, &c. odontalgia, otalgia, cephalalgia, phlegmons, cynanchies, ophthalmias, pleuritic pains, spasmodic cholics, burns and scalds, paronychiæ, contusions, atonic gout, spontaneous hemorrhages, herpes, erysipelas, &c. with many other topical affections, which might be enumerated if necessary.*

* *Dr. Elijah Perkins, of Philadelphia, informed me that in bilious cases, such as choleras, &c. in*

The instruments should be carried to some distance from the part affected, along the course of the larger nerves ; and in obstinate or fixed pains of long standing, the friction should be continued until a slight inflammation is excited ; but in erysipelas, and other superficial inflammations, the friction should be very light on the inflamed part, and principally confined to the edges of the tumor. In removing pains from the head, the hair should be perfectly free from pomatum or other adipose substances ; and all parts on which the operation is performed should be free from sweat, oils, &c. In pleurisy, cholics, &c. a diaphoresis not unfrequently succeeds the operation, and sometimes

which the usual remedies had failed, he has effectually removed the disorder at the stomach, and restrained the vomiting in at least three cases out of four, by operating with the trajectors on the region of the stomach and liver. He further informed me, that he has cured periodical fevers by operating on the spine during the exacerbation.

It is to me not improbable, but electricity is the proximate cause of fever ; the opinions on that subject are many and confused ; and it is perhaps reserved for some fortunate physiologist to decide the controversy, by bringing this conjecture to the test of experiment.

Electricity is already proved by philosophers, to be concerned in almost all natural phenomena, and on examining further it may possibly be found to be, the primum mobile of nature, both animate and inanimate.

faintness is produced, by the sudden abstraction of nervous energy. In a case of cephalalgia, if the pain is confined to the fore part of the head, it is immaterial whether the hair is pomatumed or not. A few days since, I awoke with a most rending head-ache, unaccompanied with fever, I delayed the operation some hours, on account of my hair being pomatum'd, but the pain became so insupportable (and all the usual applications failing) that I resolved to make trial of the tractors, as the pain was for the most part in my forehead. After the operation had been continued a few minutes on my forehead, and the back of my neck, I was perfectly relieved from pain; and have remained so ever since.

It is argued by some, (who are opposed to the Metallic Operation) that the efficacy of the tractors depend merely on a counter irritation produced by friction. I would ask those dogmatists how metallic friction cures burns, or topical inflammations? Does not the least impression on an inflamed part produce pain; and would not friction augment the evil? Phlegmons, and some other topical inflammations, may often be removed, by exciting a counter irritation with blisters, &c. which restore the equilibrium of the nervous fluid. But blisters seldom answer any valuable purpose in local inflammations, accompanied with excessive action of the arterial system, until the fever is previously diminished. Neither will the Metallic Process succeed so well in the acute, as in the chronic rheumatism, while the febrile

action remains inordinate.* This shews a correspondence in effect, but the modes of operation are diametrically opposite. The former is by an indirect, organic process; the latter, by a direct and specific operation. And all pretensions towards identity, are precluded by the diversity in their effects, on burns and phlegmons, as beforementioned. Phlegmons, and other topical affections, are owing to an internal or external irritation on the nerves of a particular part; by means of which, the vessels of the part are also brought into action, and not unfrequently the whole vascular system acts in concert, from a sympathetic harmony primævally established.

Spontaneous Hemorrhages, are those which depend on a local excess of tone or electricity,

* *The partial success of the metallic operation in febrile diseases, may be rationally imputed to the limited mode of operating. For as fever is a universal disorder, the modus medendi, must be general also.*

When local remedies are used in fevers, a general effect is contemplated by bringing the system into sympathetic action. Thus blisters will frequently procure a crisis in continued fevers, when the usual internal remedies have failed. And as there is often a spastic contraction of the capillary vessels in continued fevers, the metallic operation would probably procure a salutary diaphoresis, if extended over the surface, or even applied along the spine and thorax.

denominated (by the illustrious *Cullen*) a hemorrhagic effort.

Herpes, are the product of a morbid or excessive excitement in the vessels of the cutis; the encrustation is formed by excessive action. The metals remove this inordinate action, by abstracting the extra degree of electricity. Corrosive lotions destroy the morbid action by corrosion, and induce or restore the condition for healthy action.

Burns. The stimulus of heat produces inflammation, by exciting and accumulating the electroid fluid.

Epilepsy is owing to an irregular distribution of the nervous fluid, and an accumulation thereof in the muscles affected with spasm. That this is the fact, is obvious from the preternatural strength of epileptics.

Pain, is merely an accumulation of electricity, in a particular part; and the subsequent state of ease is obtained by abstracting the extra degree of sensibility. Hence the frequent faintings in parturition, cholics, &c. are to be imputed to a diminution of nervous energy.

In chronic pains connected with idiosyncrasy or dependant on habit, so that the orgasm of the part is injured, or a mal-conformation induced by nature or accident, the Metallic Process cannot be expected to succeed.

When suppuration has taken place, the tractors must be considered as mere palliatives.— This operation should never be performed on the back, during the existence of the catamenia. Besides those cases in which the tractors have

already been found successful, future experience will probably develope many others, in which the Metallic Operation will prove equally efficacious. This operation will also, in all probability, succeed better in some persons than in others. For example:

Many people are remarkable for an extreme lustre in their eyes, some are so much electrified naturally as to shew evident signs of it when a sensible electrometer has been applied to them, and others have manifested an extreme sensibility of even the smallest degree of electricity, insomuch that they would be affected by a flash of lightning, though so remote that the thunder could not be heard. All this evinces that electricity so far from being noxious, bears a very active and salutary part in the Animal Œconomy, which will probably lead to more important researches on this interesting subject, and incite future travellers to explore the remaining *terra incognita*,

F I N I S.

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